SCIENCE NEWS-LETTER

The Weekly Summary of Current Science

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FISH'S-EYE VIEW OF THE TROPIC SKY

The Struggle for Existence, Where the Warm Seas Run

(See page 238)

Vol. XV No. 419

Graves of Inca Nobles Found

Archæology

Nearly 300 pottery vessels, chisels, axes and other tools of copper, bronze and stone, as well as gold earrings and a head-band of the same metal one-and-a-half inches wide and sixteen inches long that was once tied around the head of an Indian lord like a diadem, are among the objects recently found in an Inca cemetery at Copiapó in northern Chile while a man was digging on his property near a river bank.

Gualterio Looser, assistant curator at the Museum of Natural History at Santiago, has examined the site. The graves are placed in groups of ten to twelve, each group separated from the others by a wall of stone. Graves of ancient *caciques* or nobles of this part of the world were customarily segregated from common folks by masonry walls, and it was within these enclosures that the relics were discovered, in graves about eight feet deep.

Although the cemetery is believed to have belonged to the Incas of the period shortly before the Spanish Conquest, some of the objects show styles of other and earlier cultures. The Incas were newcomers in Peru, like the Aztecs in central Mexico, and reached the height of their power only in the last few centuries before the discovery of the New World. The Inca empire once reached from Ecuador to central Chile, and within its boundaries a large number of different racial groups lived together in a remarkably advanced social state. But before the last Indian empire of South America reached its height, other great cultures and political organizations had prospered and disappeared.

Practically all the pottery objects found at Copiapo are patterned after well-known prehistoric Andean models. The general tone is cream, and against this background the design is carried out in deep red or some other strong color. The vessels show no sign of use after they had been made, but many of them were broken when they were buried with the dead, a custom followed in many parts of the Western Hemisphere in ancient times, and called "shooting the quarry" by archæologists.

The find revealed a number of unusual pieces, among them two funerary urns such as were used by the prehistoric people on the other side of the Andes in Argentina for burying infants. The upper part of these urns represents a bird, whose face, with a human expression, is on the front and the tail and feet at the back.

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Fish's-Eye View

Zoology—Optics

Our cover this week is from an unusual painting made for the Buffalo Museum of Science by Wilfred Bronson, portraying an incident in the struggle for existence that goes on unceasingly beneath the quiet blue waters of the warm seas. One of a school of dolphins, the fastest fish that swim the sea, has taken a fancy to a bite of flying-fish for lunch. These living combinations of submarine and airplane have taken to their natural refuge from aquatic foes. Having broken water, they are gliding down the air on their expanded, wing-like fins, propelled by the inertia of the rush that carried them out of the water.

Their advantage over the pursuer does not end with their having entered a medium where he can not follow them. From beneath the surface the whole aerial hemisphere is contracted, by the refraction of light, into a comparatively narrow circle. While they are high overhead, the flying-fish can still be seen by the dolphin. But as they drop back toward the surface they are still seen, but in quite a different direction from where they actually are. And since by then they are some scores or even hundreds of feet from their starting point, they are out of the range of vision of their submarine enemy.

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In This Issue—

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Heredity, Environment and Hoover

Eugenics

Heredity and Hoover

By LEON F. WHITNEY

Dr. Whitney is Secretary of the American Eugenics Society.

Look at a picture of Herbert Hoover and compare it with that of his mother and you see where the President got a large share of his looks. The inheritance of physical traits is easy to understand.

In fact, no one doubts the powers of heredity so far as physical traits are concerned.

We look at a fine corn plant and know it is fine because of a long-time selection which produced it. We know the 300-egg-per-year hens differ from the common barnyard variety almost wholly because of their heredity. We look at our own pictures and decide that we got our looks not by accident, but by heredity.

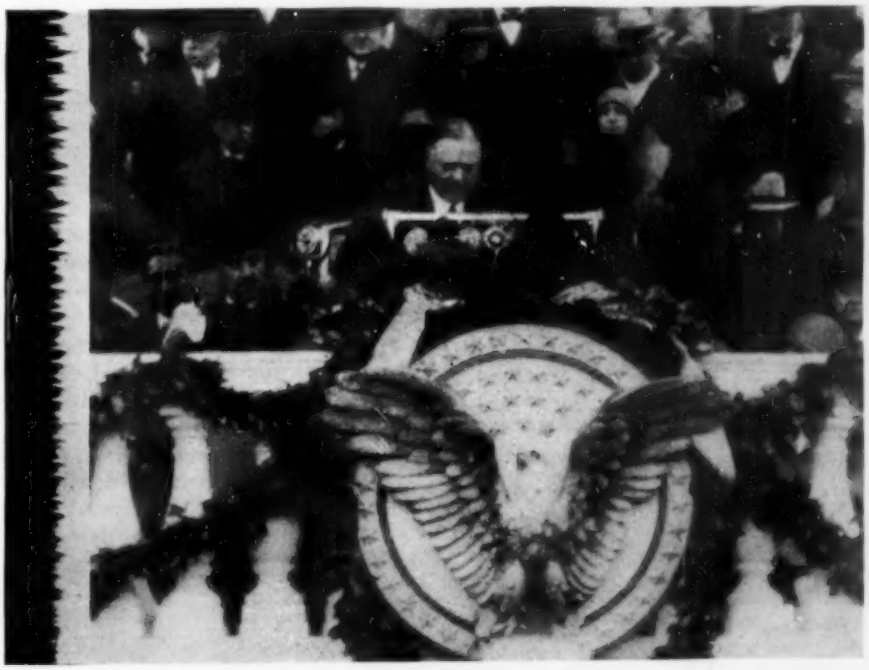
It is when we enter the realm of the mental traits that confusion begins. But the brain is a physical organ, and the brain governs our thoughts and actions. We respond to stimuli from outside.

The idiot, imbecile, or the moron grades of intelligence can certainly not be expected to achieve any intellectual fame. The constitutional force simply is not there. Twenty-five per cent. of our people have inferior and very inferior intelligence. Only twenty-lve per cent. have superior and very superior. Only the top four per cent. have very superior intelligence.

No psychologist doubts that Herbert Hoover comes within this top four per cent. Where did he get his intelligence? From the air he breathed? From the water he drank? From his mother's tender care? Oh, no. That degree of intelligence was fixed when he was a single cell. He has never been able to alter it, but his broad experience has made him wise.

Herbert Hoover's success is a matter of mental, not physical traits, although his good health has been a great asset. That is why there is no room for any dispute as to which was more important in shaping the present product.

Our first conclusion therefore is that his heredity is of great importance to him because it saw to it that he was one of the top four per cent. of our people. Environment had nothing to do with that.



THE PRESIDENT'S VOICE PHOTOGRAPHED. This picture of Mr. Hoover as he delivered his inauguaral address was enlarged from a single frame of motion picture film in the Pathé Sound News reel of the event. The jagged line along the left is the sound record, recorded by RCA Photophone, which is converted into a replica of the speech when it passed over a photoelectric cell in the projector. (Photo by courtesy Pathé News.)

Jesse Hoover, Herbert's father, died of typhoid fever when he was 33. Herbert was then six. Huldah, Herbert's mother, died when he was nine. Assume that little Herbert, an orphan, had no "folks" to look after him and that we are considering this child with the idea of adopting him.

Remember that a person is not the product of his mother or father, but rather of the whole stock from which they and he came. First, consider the general stock of which his specific stock was a part. Was it the sort of stock that produces one eminent man in many thousands or one in seven?

Let's take a look at the stock. Quaker. What are Quakers? They are a very highly selected stock—judged on a mental basis. They have strong convictions. No easy life for them—no ungodliness, rather isolation and the contempt of certain others.

It takes character and idealism to make such decisions and to live up to them. It takes self-control, will power, persistence.

Herbert Hoover came of excellent general stock. But what of his ancestors? They, too, may help us decide whether or not to adopt this boy.

Hoover's ancestors were mostly of colonial stock. Many of them were land owners. Quite a large number were pioneers living on the frontiers, spreading out, seeking new lands to subdue and live on and keeping always to the Quaker faith. They founded West Branch, Iowa, where Herbert was born and, it is said, broke ground for the meeting house before they began to clear the land.

A study of Hoover's ancestors reveals men and women of glorious character. It was the custom to farm—most frontiersmen were farmers, but a great amount of mechanical ability is found on Herbert's father's side of the family. All through the line there was a high regard for intellectual things.

This shows what heredity was doing. Farming had to be the industry in those early days, but farming did not offer enough for an active mind. Thus—"His grandfather on the Minthorne side is remembered as a bookish farmer who carried his favorite volumes in his saddle bags."

More than that, there are no records of defectives in the Hoover stock.

Indeed, from his general stock and from his specific stock Hoover promises well. (*Turn to next page*)

Heredity, Environment and Hoover—*Continued*

Look at his parents, because he is more closely related to them than to his grandparents or others.

His father had stepped into commerce, having broken away from farming. He had a blacksmith shop and machine agency. He was becoming a real success at it when, at the age of 33, he died. Some who knew both the elder Hoover and the President, see some of his father's qualities in the son—especially his mechanical ability.

Herbert's mother, Huldah, was a woman of great native ability. Not only did she support the family for four years until she died, but she became a much sought after "speaker" at the Quaker meetings. This, indeed, was exceptional. Much of the family's living came from her sewing, which she did artistically and rapidly.

One thing is obvious—none of Herbert Hoover's ancestors rose to great eminence. But that does not indicate that latent genius was not present. Latent and revealed genius are not the same. The seed from which Hoover came was rich with latent genius; the soil in which the seed was sown had not all of the elements necessary to bring that seed to fullest fruition.

Herbert Hoover is one of those rare gems come to light where his ability may be appreciated.

On several occasions after I have spoken, someone in the audience has propounded the oft-asked question, "You say the large family has so much in its favor; what do you think about having one or two children and giving them more advantages?" To which I always reply: "Are you sure what constitutes genuine advantages?"

My own idea of real advantage is different. I suggest this formula in child training if you want to bring out the best that is in a lad: give the child all the adversity he can stand and still not break his spirit!

Herbert Hoover fought adversity the greater part of his early life. The advantages of this sort of education were real and allowed his potential capacity to come to full fruition. Thousands of boys have been forced to serve even harder apprenticeships, but the lack of their heredity prevented their achieving any great success.

The boy who climbs from obscurity to deserved fame has more than opportunity to help him. He has a constitutional force which grew from a good heredity which was planted where it could develop.

Hoover's Environment

By Mandel Sherman

Dr. Sherman is Director of the Washington Child Research Center.

When any man is brought to the attention of the nation and his achievements are suddenly realized, everyone becomes interested in the reasons for his rise to fame. Many people would ascribe his accomplishments to inherent endowment, a natural result of hereditary influences.

Thus it is with President Hoover, a man who has done exceedingly good work and has a record of many accomplishments. The absence of any startling or unusual incidents in his past life makes it appear easy to account for his remarkable success in terms of hereditary influences.

People often think of heredity as some mysterious force which shapes a man's destiny regardless of his experiences in early life. The cause for such assumptions is evident—the final man and his immediate past accomplishments are before us, but we know very little, nor do we care in most cases, about the forces in his early life which helped to shape him.

Psychologists know that the average person often thinks of any event in terms of the cause just preceding it. He forgets that the last cause is but one of many and that the final happening is the result of their cumulative effect.

Looking into the incidents of President Hoover's early life we find many conditions which ordinarily would go unnoticed but which, by their cumulative effect, no doubt had a profound influence in shaping his career and personality.

He worked even as a child, and when but a youth had to be largely self-supporting. He early began to develop independence of thought and purpose which served him so well later on in life.

His earliest experiences were full of hardships. The modest means of his parents required a thriftiness which is exemplified throughout most of his life. Almost everyone around him was thrifty and practical and fostered these traits.

The orthodox religious attitude of his parents and the early death of the father, which narrowed the mother's interests to sewing and religious work, helped to develop in Hoover "introverted" characteristics, that is, shyness, antipathy toward public appearance, dislike of superficial friends and an attitude of looking into every situation closely with the viewpoint of examining it in its relation to his future welfare.

In his early life, as also later on at Stanford University, Hoover became interested in results rather than in individual incidents. A person with opposite personality traits often is interested as much in the minor incidents of any situation as in the final result, but Hoover always looked toward the final accomplishment. This made it necessary for him to concentrate on particular problems.

The restraint fostered by his early religious training further gave him a tenacity of purpose and the ability to steadily pursue a line of work without dissipation of interests. His original endowment of physical strength and intelligence made it possible to accomplish many tasks which would otherwise have been impossible.

Although it is generally believed that intellectual capacity is hereditary, recent experiments have shown that environment does play a role. Wide differences in intelligence are due to heredity, but a normal child does benefit by good environment.

Imbecility and idiocy are inheritable defects, and such defectives never develop normally. However the intellectual growth of a normal child may be speeded up by good environmental conditions.

When Hoover went to Stanford his experiences there also were conducive to the development of an "introverted", strong-minded person with set purposes and with the ability to concentrate and to work hard for a long time in order to accomplish any pre-determined task.

It is known that he did tackle many tasks during his college career and that he was usually successful.

His very modest means and lack of social prestige set him outside the pale of the fraternities, the members of which usually were financially independent and had a so-called good social background.

Furthermore, he had to work outside of class hours and would have been unable to participate in social affairs even had he been accepted in their circles.

This was a further stimulus to his intense desire to accomplish something worth while and to become independent of any situations set down by custom and traditions. (*Turn to page* 247)

No Heartbeats in Plants

Botany

"Hearts" in plants, propelling the sap upward by rhythmic beats, are denied any real existence by several American and European plant physiologists, whose repetitions of the widely heralded experiments of Sir Jagadis Chunder Bose have not given results like those claimed by the Indian scientist. The "pulsations" shown on his records, they state, are due simply to the tremors of imperfectly adjusted instruments, and when these sources of error are eliminated the apparent pulsations vanish immediately. Without these precautions, a round lampwick soaked in cabbage juice shows "pulsations" of exactly the same kind detected in the living stem of a plant.

The newest attack on the Bose theories is by Dr. G. A. Persson of Mt. Clements, Mich., in an article which appears in the *Scientific American*. Dr. Persson, a physician interested in the physiological effects of poisons, was attracted to the Bose experiments by the reported effects of strychnine and other drugs on the "heart-action" of plants. He and his assistant built duplicates of two of Dr. Bose's pieces of apparatus, the electric probe and the sphygmograph.

Both of these instruments are supposed to register minute increases and decreases in the diameter of plant stems, making them readable to the naked eye by deflections on the scale of a sensitive galvanometer. Dr. Persson did get wiggly-line tracings that resembled those of Dr. Bose; but he states that when he carefully insulated his apparatus against vibration and electrical disturbance, and refrained from walking near his plant or causing any air currents in its neighborhood, the apparent pulsuations stopped compleely.

These negative results agree with those of an Irish scientist, Prof. H. H. Dixon of the University of Dublin. Prof. Dixon built an electric probe some time ago and also a third instrument used by Dr. Bose, called a quadrant electrometer. He was not able to detect any heart-like pulsing in plants with either of these pieces of apparatus.

Prof. Dixon, following some preliminary work done by other experimenters on the continent of Europe, was able some years ago to demonstrate that a continuous column of water in a sealed vessel has a strength like a woven rope, resisting a breaking strain of several hundreds of pounds per square inch. This tensile strength of water is sufficient to pull sap up to the tops of the tallest trees as though each microscopic water tube in the sapwood had a slender steel wire strung through it. The evaporation at the leaf-surfaces furnishes the pull, according to Prof. Dixon's theory, and the water-columns themselves act as cords to lift themselves.

Almost all plant physiologists have now accepted Prof. Dixon's hypothesis of the ascent of sap. Among the most notable of his American supporters is Dr. D. T. MacDougal of the Carnegie Institution of Washington, who has tested the theory on a large scale at the Coastal Laboratory at Carmel, Calif., of which he is director. The results of these experiments, Dr. MacDougal states, are a confirmation of Prof. Dixon's ideas and a refutation of those of Dr. Bose.

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Hay Fever Season Opens

Hygiene

Little grains of pollen blown on an April breeze may be the innocent cause of many sneezes from early hay fever sufferers. The season for this trying malady is now at hand and, in the opinion of medical specialists, hay fever victims should arrange to be desensitized without delay.

While pollen from summer and fall grasses and weeds causes most of the hay fever, there is an early variety due to certain trees and shrubs that blossom early. In warm climates this may be mistaken for a common cold of late winter. Rose fever is one name given to this early variety of the malady, though it is caused by many plants besides roses.

As a matter of fact, it is a protein substance in the pollen of plants that causes hay fever. Some persons get it from protein in foods, animal hair or feathers, glue, horn rimmed glasses, and many other queer and unexpected sources. Physicians have devised a way of testing which pollen or protein is the cause of hay fever in any given person. Treatment to make the person less sensitive to the guilty substance may then be instituted. An amount of the particular protein so small that it will not cause a reaction is injected under the skin of the patient. This is done about once a week, gradually increasing the amount of protein injected, until the test shows that the patient no longer has any reaction to it.

Treatment is generally started about fifteen or sixteen weeks before the time the hay fever customarily begins. It will not help all the sufferers, but 25 per cent. can be completely relieved.

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Too Many "Outlines"

General Science

WILLIAM LYON PHELPS in a letter to the American Philosophical Society:

"The world's intellectual need is more sound culture, that is, both science and the humanities, based on knowledge. I think the various 'outlines' published today, while they may accomplish some good, do a great deal of harm in persuading some people that there is an easy way to knowledge."

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Asparagus Vitamins

Physiological Chemistry

Thick, white asparagus sprouts are rather more fashionable than their green brothers, but they are lacking in vitamin A. So if you rely on asparagus for your vitamins, you must eat the green variety, or you will not be getting enough vitamin A in your daily diet.

Experiments carried out by Prof. J. W. Crist and Prof. Marie Dye at the Michigan State College showed that green asparagus, whether freshly cooked or canned, contained enough vitamin A to promote health and growth when fed daily to white rats. These animals are the ones regularly used to test the vitamin content of foods. When they were fed the blanched or white asparagus without any other source of vitamin I in their diet, they died as rapidly as on the control diet containing no asparagus and also no vitamin A. Evidently blanched asparagus gives no stimulant to health and growth.

Prof. Crist and Prof. Dye believe a relationship exists between vitamin A content and the development of chlorophyll, the green coloring matter of plants.

Science News-Letter, April 20, 1929

Biology

By William H. Atwood
Director of the Department of Biology
Milwaukee State Normal School

Edited by S. R. Powers, Ph. D.
Professor of Natural Science
Teachers' College, Columbia University

338 *Illustrations.* 522 *Pages.* *Cloth,* $1.68

ALL of the great principles of life operate in a uniform manner in the activities of plants, animals, and man. Digestion, respiration, irritability, reproduction, heredity, etc., are such activities. Each activity of living things can be studied and understood more effectively if studied in a course in biology wherein plants, animals, and man are considered in one unit instead of repeating the study of each function separately three times and in different terms of the school year.

The greatest good and interest in biology comes from gaining an understanding of the intimate relationships of plants and animals to man. This relationship can not be shown effectively and interestingly if a consideration of man is deferred to the end of the course.

Plants and animals are associated together in nature, and their activities are interdependent. It is the way of nature to think of them together, and it is the more natural method of observing and learning.

Contents

The presentation of the subject matter is pedagogical. Suggestions to pupil and teacher in the form of questions, activities, field trips, projects, reports and lists of references are scattered throughout the text and there is a glossary at the back of the book.

The author expresses the opinion that the greatest good and interest in biology teaching comes from gaining an understanding of the intimate relationship of plants and animals to man. Activities and functions for plants, animals and mankind are treated in a united study. The text is suitable for use in the tenth year or later in the high school course. It is an excellent text built along modern lines.

School Science and Mathematics.

P. BLAKISTON'S SON & CO. Publishers 1012 Walnut St. Philadelphia

Where Did You First See These Words?

Lexicography

The New English Dictionary on Historical Principles, commonly known as the Oxford Dictionary, aims to include a literal quotation of the first use in print of each word. The dictionary has now completed the alphabet, but a supplement is being prepared. The editor, Dr. C. T. Onions, is asking the help of readers in general for information as to the first appearance in print of the new words being defined. From the list of the Desiderata of the Dictionary, we copy the following words in which our readers are likely to be interested:

accelerate (an engine)	1902
accelerator	1900
ace (airman)	1918
acetate silk	1925
acetylene gas	1895
acidosis	1905
across, put it or get it	1921
adenoids	1901
adrenal	1875
adsorb	1923
agar	1889
aileron	1909
aircraft	1907
airman	1910
alcoholic (noun)	1907
all in (exhausted)	
alpinism	1884
alternating current	1882
alternator	1893
amatol (high explosive)	1918
amberite (explosive)	1893
ammonal (explosive)	1903
amperage	1901
amplifier	1919
amylopsin	1886
anabiosis	1890
anabolism	1889
anastigmatic (lens)	1897
animated picture or photograph	1898
announcer (broadcasting)	1923
anopheles	1899
anthropic	1884
anthropometer	1881
anti-body	1901
anti-clockwise	1909
antipyrin	1884
antitoxin, -ic	1892
aplanat (lens)	1895
apochromatic (lens)	1887
arc-lamp, -light, lighting	1882
arteriosclerosis	1890
ask out (invite)	
astrophysics	1890
atichoo, atchoo (sneeze)	
atmospherics (wireless)	1915
attune (wireless)	1901
audion	1915
auto (automobile)	1902
autobus	1900
autocar	1895
automobile (adjective)	1886
automobile (noun)	1895
automobile (verb)	1898
auto-suggestion	1890
aviate	1900
aviation	1887
aviator (aeroplane pilot)	1896
aviculturist	1904
bacillicide	1890
back-fire (in an engine)	1897
back number	1888
bacteriological	1886
baking-powder	1878
ballyhoo	1914
bargain-counter	
barn dance	1895
barocyclonometer	1906
base hospital	1895
bats in the belfry, to have	1927
batty (balmy, dotty)	1922
be long, now we shan't	1897

The date attached is that of the earliest quotation that has been so far found. If you know of any earlier employment of the term, it would be a favor to the Dictionary if you would send in the reference, copying the passage accurately with full details as to the author, title, date, and page, etc., following the form used for the quotations in the Dictionary. Mail the slip to the Secretary, Clarendon Press, Oxford, England, marked O. E. D., or in care of Science Service, Washington, D. C.

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Girls Most Credulous

Psychology

Girls take more stock in fortune-telling than boys, whether of the tea cup, palm reading or playing card variety, according to a report made to the *Journal of Abnormal and Social Psychology*. This greater credulity of the so-called weaker sex showed up in tests with some 6,000 school children, made by Dr. Harvey Lehman and Paul A. Witty of Ohio University and the University of Kansas.

Girls of all ages took greater interest in dabbling in the occult than boys, the peak being reached at around the age of thirteen years. Boys tend to outgrow their superstitious leanings as they approach manhood put girls do not, the investigators found.

They suggest that this state of affairs may be due to the greater importance of emotions in the life of a woman and also to the restricted range of feminine activities. These forces, it was stated, may cause women to fall back on superstition for guidance more frequently than men.

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Tornado Record Exceeds Normal

Meteorology

The tornado record for the first quarter of 1929 as shown by information gathered by the U. S. Weather Bureau promises another unusual year for these disastrous storms.

Last year more tornadoes occurred in the United States than during any previous year for which the government meteorologists had gathered data. The record for 1928 nearly doubled the usual number of 90 to 100 a year. But the loss of life due to tornadoes in 1928 was exceedingly small and the property loss was far below that of the worst years.

In the first two months of this year 10 tornadoes caused 32 deaths, compared with only four tornadoes and no deaths in January and February of 1928. March kept up the unfavorable condition with some half dozen whirlers and a dozen or so of deaths. And the Arkansas tornado toll gives April the beginnings of a bad showing.

As May and June are the months that usually show the largest damage from tornadoes, meteorologists feel that more storms and suffering must be expected.

The tornado is born of currents of air above the ground that differ in direction and come in contact. A condition of warm, moist air near the ground overladen with cold air sets up violent heat transfer and overturning of the atmosphere. A great whirl or vortex results releasing the pent-up energy of the air. Not always does the funnel-shaped cloud reach the ground, but when it does the low pressure of its center explodes houses and the wind about the vortex prostrates all that it encounters. Usually a tornado moves east or northeastward at the rate of 25 to 50 miles per hour. If you see one coming at you, run as hard as possible toward the northwest, as, due to the small path, a few feet may mean the difference between danger and safety.

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Research in Radio

Radio

E. P. EDWARDS, in *The Radio Industry* (Shaw):

While the radio industry that we know today started its rapid growth with the conclusion of the World War, its genesis considerably antedates this period. In the design of radio receiver and loud speaker combinations, for instance, we have been able through the medium of organized research to take advantage of the contributions of such workers as Hertz, Maxwell, Faraday, Heaviside, Helmholtz, Rayleigh, and others.

In order to better understand the character of the foundation upon which we are building, let us consider the more important, conscious engineering contributions to the radio art which have become available in this present century.

The first practical high-frequency alternator was developed by Alexanderson in 1906; it was of the induction rotary disc type, having an output of two kilowatts at 100,000 to 200,000 cycles, and marked the beginning of the end for those systems of transmission employing damped waves. This little machine with its associated equipment was the forerunner of the 200-kilowatt generator which now links this country, through radio, with Great Britain, France, Germany, Sweden, Norway, Holland, Belgium, Italy, Poland, Turkey, Venezuela, Dutch West Indies, Dutch Guiana, Colombia, Porto Rico, Argentine, Brazil, Hawaii, Japan, Dutch East Indies, French Indo-China, and the Philippines.

At the time of this development we had the Fleming valve, or two-element tube, capable of detecting radio signals. The use of this tube marked the transition from detectors of the coherer, electrolytic, and crystal types to the present three-element tube. Subsequently, DeForest added a third element, the so-called "grid," which materially broadened the functions of the Fleming valve and provided not only a more sensitive detector, but also a tube capable of functioning as an amplifier and oscillator.

With the high-frequency alternator at the transmitting end and the three-element tube at the receiving end, there resulted a more dependable system of radio communication, employing Morse and similar codes, but as yet this system was not flexible enough to transmit speech effectively and practically. The coming of the power tube is an outstanding instance of the far-reaching effect of pure science on all industrial development. It has proved to be one of the most important factors in the radio art to date. Its future applications may be of even greater value to mankind.

Edison, in his early work on the incandescent lamp, observed a phenomenon which has since been known as the "Edison effect"; he noticed a blue glow in some of his lamps which rapidly disintegrated the filament near its terminals; he guessed that a current was passing through space between the terminals and proved that to be so by placing an electrode in the bulb and passing current between the filament and the electrode. He found that this current would pass in one direction only and that the tube was therefore a rectifier.

These experiments of Edison's were the basis for Fleming's inventions, which were followed by that of DeForest. The Fleming and DeForest tubes were low vacuum tubes. Only very low voltages could be used with these tubes. Prior to Langmuir's invention of the high vacuum tube, the special treatment necessary to the production of a high vacuum, hot cathode tube was not known; nor was it appreciated, apparently, that there would be any particular advantage in such a tube. Langmuir found how to produce a high vacuum, hot cathode tube and found that with such tubes very high voltages and large currents could be used. As a result of these discoveries we were able to produce power tubes of a commercial type with outputs up to 100 kilowatts.

The power tube is the heart of the broadcast transmitter. The broadcast transmitter enabled us to supplement signal transmission by voice transmission, and has become the "tail that wags the dog," in an industrial sense.

In a radio sense, there has been no more important problem than that of transmitter development. While there is little probability that transmitter design and manufacture will result in mass production, it is an outstanding fact that this development is the basic reason for mass production of receiving and reproducing equipment. Consequently, continuous scientific research and development must be employed if we are to hold the interest of the listener-in, and expand our field of endeavor.

The history of radio is like that of any other extension of knowledge, either physical or mental; it is the union of independent, partial contributions of discovery or interpretation, which are found to be interrelated parts of one harmonious, comprehensive whole.

The invention of the tungsten filament and thoriated tungsten filament are outstanding contributions of research, and constitute an important step in our endeavor to secure minimum current consumption and better overall performance. These advances are of particular interest, as they indicate the economic effect of research.

The list of different-purpose tubes is large, embracing the rectifier tube used for many purposes, the various types of tubes capable of using alternating current for filament excitation, amplifier tubes, and the four-element screen grid tube, which is assuming greater and greater importance in the solution of amplification problems.

Facsimile telegraphy, television, radio beacons, carrier current communication, are all special applications, centering around the transmission of radio signals. In addition, there are "other purpose" applications of radio transmission such as telemetering, remote control, and synchronization. These by-products of radio development may become important factors in our everyday life when their development is completed and their value realized.

The so-called by-products are not limited to applications involving radio transmission. Even today, devices and equipment resulting from radio research are utilized in the automatic selection and grading, by color, of cigars, pearl buttons, coffee and breakfast foods. Many other interesting applications, such as high-frequency furnaces and automatic elevator leveling equipment, give promise of industrial expansion along lines that had not been thought of until present-day radio made its appearance.

Take one little device as an outstanding example—magnetic pick-up—this, coupled with a method for the electrical cutting of phonograph records and electrical reproducing equipment (all products of radio development), has rejuvenated the phonograph industry, which for a time appeared to have suffered a death blow as the result of radio competition. This competition, through the good offices of research, has been converted into an ally.

Astronomer Discovers Fastest Nebula

Astronomy

The fastest known motion in the universe for a large body has been found, in a spiral nebula that appears to be moving away from the earth with a speed of 2,348 miles every second. This has been determined by Dr. Milton L. Humason, of the Mt. Wilson Observatory, with the aid of photographs of the body's spectrum made with the 100 inch telescope, largest in the world. The nebula can only be observed with the aid of a large telescope, and is known as N. G. C. 7619, its number in the New Catalog of such objects.

Dr. Humason's work has also shown that the nebula is at the vast distance of about 25 million light years, so far away that the light from it which affects the astronomer's photographic plate now has been travelling for the last 25 million years. Every second light travels 186,000 miles and every year about 6 trillion miles.

The method used for measuring the motion of the nebula depends on the wave-like properties of light. When a ringing bell, as on a train or fire engine, is moving rapidly towards a person, the bell sounds of a higher pitch than when it is standing still or rapidly moving away. It is due to the fact that when the bell is coming closer the sound waves are pressed together and the result is the same as if the waves were shorter in length. In the case of the receding bell, the waves are spread out and seem longer. The longer the sound waves, the deeper the pitch, and the shorter the waves, the higher the pitch.

A similar effect is observed with light. When the light from a star that is rapidly moving from the earth is examined with the spectroscope, which analyzes light, it is also found to be of a lower pitch, or more reddish, than from the same star if it remained at the same distance from the earth. This is shown up by a slight displacement of the dark lines crossing the star's spectrum. A shifting of the lines from their proper places towards the red end indicates that the star is receding, and a shift to the blue that it is approaching.

In the case of the nebula N. G. C. 7619, Dr. Humason found that the lines showed a marked shift to the red. This shift was as much as would be caused by a motion away from the earth at a speed of 3,779 kilometers, or about 2,348 miles, every second.

That it may not be a true motion of the nebula with respect to the earth, however, is shown by the researches of Dr. Edwin P. Hubble, one of Dr. Humason's colleagues. It was Dr. Hubble who first proved that the spiral nebulae are independent systems of stars, like the Milky Way system of which our own sun, as well as all the stars we see in the sky, is part. He has measured the distances of more than twenty of these nebulae, and found their motions. The farther away they are, the more rapidly they seem to be moving. All are moving away from the earth, for the spectral lines of all of them are dis- (*Turn to next page*)

Astronomers En Route to Eclipse

Astronomy

With the sailing of Dr. Harlan T. Stetson, Harvard astronomer, to the Malay Peninsula, where he will observe the eclipse of the sun on May 9, the third American expedition is under way. Also crossing the Pacific for a similar purpose is Dr. R. L. Waterfield, an English astronomer, who prepared for the eclipse in Baltimore. He is bound for the Philippines.

The Harvard expedition, in addition to Prof. Stetson, consists of Mr. and Mrs. Weld Arnold, of the American Geographical Society, New York, and Josef Johnson, of the California Institute of Technology, at Pasadena. They will disembark at Penang and proceed by rail to Alor Star, capital of the Province of Kedah.

The purpose of this group will be to make measurements of the brightness of the sky during the eclipse, and of the corona, the outermost layer of the sun, revealed only at eclipse time. A number of photographs will be taken with different sized cameras to record the outermost parts of the corona. One novel research will be concerned with the brightness of the zodiacal light. This is a glow that appears sometimes in the sky after sunset or before sunrise, stretching upward along the ecliptic or path of the sun. It is due to a flattened cloud of fine particles, very much scattered, that surrounds the sun, and reflects sunlight to the earth. Before sunrise or after sunset, its ends are visible. It cannot be seen with the naked eye during an eclipse, but Dr. Stetson hopes to make measurements of its brightness with his photometers, and to determine whether there is any relation between it and the corona itself.

Another instrument that he will use is a camera equipped with a lens made of quartz and silvered, so that only the rapidly vibrating and invisible ultraviolet light can pass through to the sensitive plate. With this he will make photographs of the corona in ultraviolet light for the use of Dr. Edison Pettit, of the Mt. Wilson Observatory.

Dr. Waterfield's expedition includes, besides himself, Wyndham E. B. Lloyd, of Cambridge University, England. He will locate in the Philippines at Iloilo, near the site of the party from the U. S. Naval Observatory in Washington. The chief instrument will be a camera 11½ feet long with a lens 7 inches in diameter. One picture will be made with this, on a very sensitive photographic plate, and with a rotating shutter. This will permit the faint outer reaches of the corona to be photographed without overexposing the much more brilliant inner part. The shutter consists of four aluminum vanes, which will revolve immediately in front of the plate. The outer part of the corona will be exposed for about 200 seconds, nearly the whole duration of the eclipse at Iloilo, while the inner and brighter part will only be exposed for a half second.

With smaller cameras, they will make photographs of the corona with infra-red light, consisting of waves too long to be visible. As the light of the sky is weak in infra-red, it is hoped that in this way the farthest expansions of the corona may be recorded. But before sailing Dr. Waterfield pointed out that this may not be successful, for the corona itself, like the sky, may turn out to be poor in infra-red also. With a five inch diameter lens in a camera six feet long, ordinary photographs of the corona will be (*Turn to next page*)

France's Greatest Son

Biography

PAUL VAN DYKE in *The Story of France* (Scribners):

When modern France reviews the roll of her mighty dead, she recognizes her greatest son of the past century, who won for her the most lasting fame in the records of the world, not in Napoleon Bonaparte, but in Louis Pasteur, whose teaching has saved the lives and lessened the sufferings of far more men than died or were wounded in the wars of Napoleon.

Science News-Letter, April 20, 1929

Since the price of liver has soared, due to its use as an anemia treatment, fish hatcheries have found that fresh-water shrimp is a suitable substitute for ground liver as fish food.

Fastest Nebula—*Cont'd*

placed to the red. Dr Hubble has not measured the distance of N. G. C. 7619, but judging by the relation between distance and apparent motion, it is about 25 million light years from us. Its apparent motion is the fastest of any known nebula, taking the speed record away from N. G. C. 584, which Dr. V. M. Slipher, of the Lowell Observatory at Flagstaff, Arizona, found to be receding at the rate of 1,118 miles a second.

At least part of the great apparent speed may be due to the structure of space itself, as suggested by the Dutch physicist De Sitter. Like Einstein, he has suggested that space is curved, something like the surface of a sphere, and according to his views vast distances would cause an apparent slowing down of the light vibrations, or lengthening of the waves. He also supposes that there is a definite tendency of material bodies to scatter in space, which would also partly account for the great motions.

Science News-Letter, April 20, 1929

Eclipse—*Continued*

made with various exposures, and also photographs in color may be tried. This will be done with a new English method of photography in natural colors.

With a large grating which, like a prism, breaks light up into its constituent colors, photographs of the spectrum of the eclipse will be taken. These will be made of the flash, when the last glimpse of the outermost visible layer of the sun appears just before the opaque moon covers the inner parts, and of the corona itself, in the long wave, infra-red part of the spectrum. Previously few successful photographs have been made of the eclipse spectrum in the long wave, infra-red light, so Dr. Waterfield hopes to reveal some new lines in the spectrum that reveals so much to the astronomer.

The coming eclipse is a very remarkable one because of its length. In Sumatra and on the Malay Peninsula, it will last about five minutes, and nearly three in the Philippines. An expedition from Swarthmore College, Pennsylvania, is located in Sumatra, besides the Naval Observatory party at Iloilo and Dr. Stetson's at Alor Star. Two other English expenitions have gone to the Malay Peninsula. Another group, from the Hamburg Observatory in Germany has also settled in the Philippines.

Science News-Letter, April 20, 1929

Revolving Hangar Studied

Aviation

Two projects for housing Europe's aircraft are being studied by the American Air Transport Association, Chicago. One is a revolving hangar for lighter than air craft, which the German government is constructing at a cost of $5,000,000. Building the hangar floor on a swivel will enable the huge zeppelins to take off without regard to the direction in which the wind is blowing which in turn will raise the safety factor in take-offs considerably.

The other is the two-story hangar built by Mussolini at the airdrome in Rome. Planes taxi up a 200-foot runway to the upper story, the lower being reserved for smaller planes, pilots' and passengers' quarters. Airports in this country in many instances are becoming so crowded that hangar space is either at a premium or unobtainable.

Science News-Letter, April 20, 1929

Indian Carvings Found

Archæology

Pictures that were carved into the rocks long ago by Indians have been discovered in British Columbia, Harlan I. Smith, Canadian Government archaeologist has reported. Mr. Smith came upon the rock pictures twenty miles west of Victoria at a point overlooking the Pacific Ocean. It is considered remarkable that these carvings have escaped the notice of archaeologists who worked in the region for many years.

Mr. Smith has spent the field season collecting Indian specimens in western Canada, making motion picture records in the Indian areas, and photographing the crude old paintings and carvings placed on the rocks by Indian artists.

Science News-Letter, April 20, 1929

The United States has 22,000,000 dairy cattle, an equivalent of one cow to about five persons.

Heredity, Environment and Hoover—*Continued*

His situation required some accomplishment which would compensate for his lack of financial and social prestige. Furthermore, the snobbish fraternity students developed a situation which required that they be shown that their methods of "running" the school were not infallible and that others should take command.

The organization of an opposition to these fraternities gave him the chance to defeat the fraternity students, who set themselves up as more important than he.

The intensity of his efforts, the concentration upon his task and the long hours and hard work necessary to perfect the opposition is but another illustration of the way in which Hoover sets his purpose and works constantly toward the final result.

The restriction of his interests with the consequent turning of all his efforts in one direction is noticeable throughout his life. He had no time for the various interests which the present-day youth has. At no time did he show an intense interest in art or in literature. Every particle of energy could thus be turned into one purpose.

Chance made it possible for him to learn much that makes him so admirably fitted for the presidency. His mission to Australia and to China as a mining engineer allowed him to come in contact with many people, taught him tact and diplomacy and made him familiar with various governments.

The necessity of being highly economical and of getting out of financial "jams" taught him at an early age to understand organization, and so it was during the Boxer rebellion in China that he was found to be the best person to organize the early defense of one of the foreign settlements and the distribution of food.

He who had been required to exercise the most careful economy during his early life knew well that careful organization with attention to the minutest details was necessary for the successful result in any economic crisis.

He learned, too, during his early childhood and in his youth that accomplishments are not sudden, but come about only through long and hard work, and he has followed this method throughout his life.

President Hoover's personality and abilities are thus seen to be largely the result of learning and training during his early life and youth.

His ability to concentrate, his hard work, his giving of himself to details of organization and his diplomacy and tact, now so apparent to all, are but the cumulative result of his many experiences and learning throughout his life.

Science News-Letter, April 20, 1929

Nature Ramblings

By Frank Thone

Natural History

Bird Waves

Today the woods round about may be full of birds. A few days later the air no longer rings with their incessant shouts of optimism and the injudicious early worm is safe again. The woods are practically empty of birds; there are only a few scattering stragglers.

Then comes a lull in bird travels. Another week, however, and things are lively once more; to be followed, perhaps, by another calm and another influx. Not only robins, but all kinds of migrating song birds apparently go through the same kind of cycle.

There is a theory that has gained acceptance with many ornithologists that these changes do not represent mere chance fluctuations in the bird population of any given place, not even responses to climatic variations, but that migrating birds travel in regular, more or less even-fronted hordes or waves, just like successive lines of troops going over the top. The idea is that each successive wave represents a bird population that has wintered in a different latitude from the one that has just preceded it. Thus, birds that have wintered in Virginia, Kentucky and Missouri will travel in one wave, or set of waves; birds that have wintered in northern Alabama, Mississippi and Texas will travel in another, and birds that have patronized Gulf resorts during the cold season will travel in still another. There is a considerable dispute as to whether these successive waves keep their relative order during the summer, or whether they reverse. That is, the question is whether the birds that winter farthest north go up into Canada, or whether they make only a short flight, and the birds from farther south jump clear over their territory and choose extreme territory for summer range as well as for winter.

Science News-Letter, April 20, 1929

So Many Requests have come to us for the books of

DR. EDWIN E. SLOSSON
Director of Science Service

that we have compiled a list of those books of his that are now available. Just check the volumes you wish, fill out the attached coupon, and mail to our book department.

- ☐ *Chats on Science.* New York, 1924..$2.00
- ☐ *Creative Chemistry.* New York, 1921. ..... 3.00
- ☐ *Dreams,* by Henri Louis Bergson, translated with an introduction by Edwin E. Slosson. New York, 1914. ..... .60
- ☐ *Easy Lessons in Einstein.* New York, 1920. ..... 1.35
- ☐ *Keeping Up with Science.* New York, 1924..... 2.50
- ☐ *Major Prophets of To-day.* Boston, 1914. ..... 2.00
- ☐ *The Physical Sciences.* Chicago, American Library Association (Reading with a purpose series), 1926. .....$ .50
- ☐ *Plots and Personalities,* by Edwin E. Slosson and June Downey. New York, 1922..... 1.75
- ☐ *Science Remaking the World,* edited by Otis W. Caldwell and Edwin E. Slosson. Garden City, 1925.. 1.00
- ☐ *Sermons of a Chemist.* New York, 1925. ..... 2.00
- ☐ *Smith's Intermediate Chemistry,* revised and rewritten by James Kendall and Edwin E. Slosson. New York, 1922..... 3.25
- ☐ *Snapshots of Science.* New York, 1928. ..... 2.00

☐ *Twentieth Century Europe,* by Preston William Slosson, with a supplementary chapter on modern science by Edwin E. Slosson. New York, 1927..... 6.00

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FIRST GLANCES AT NEW BOOKS

AT HOME AMONG THE ATOMS—James Kendall—*Century* ($3). This is the only book so far published and intended for the non-technical reader that attempts to explain the latest theories of the structure of the atom and the ultimate composition of matter. The latest news from this front to reach the newspaper is the atom invented by Bohr which was comparatively easy to grasp, being modeled after the solar system that everybody thought he understood. But Prof. Kendall goes two steps beyond this point and introduces us to Schrödinger and de Broglie, who are decidingly disconcerting to those of us brought up to believe in solid matter and little round hard atoms. Now we have to get used to the idea that the smallest particle of matter is merely an electrical hole in the middle of a pulsating aura. The author was born in England, has been professor in two American universities, Columbia and New York, and has now been called to Edinburgh University. In spite of this background—or because of it—his book is plumb full of jokes, all sorts, some very obvious, some very recondite. The natural aridity of the subject is further alleviated by frequent historic quotations and personalities.

Atomic Physics
Science News-Letter, April 20, 1929

THE LAW OF GRAVITATION IN RELATIVITY—Horace C. Levinson and Ernest Bloomfield Zeisler—*Univ. of Chicago Press* ($3.50). This book deals with the central problem of Einstein's relativity theory, that of the law of gravitation. As the method adopted is that of the theory of tensors, the first chapters are devoted to a detailed treatment of this subject. It is shown that there are four possible tensor laws. Two are obviously inadequate, the third cannot be eliminated so simply and the fourth is Einstein's law. The last chapter contains a brief treatment of the more elementary dynamical problems of the solar system, under a very general set of gravitational laws that includes the above set as a special case.

Mathematics
Science News-Letter, April 20, 1929

FAMOUS DIAMONDS—O. C. Farrington—*Field Museum* (25c). A brief popular account of the famous diamonds of history.

Mineralogy
Science News-Letter, April 20, 1929

FALSEHOOD IN WAR-TIME—Arthur Ponsonby, M. P.—*Dutton* ($2). A fascinating little book that reveals the truth about the stories of German atrocities, the alleged war aims, the invasion of Belgium as a cause of the war, and many of the other pieces of propaganda that we swallowed twelve years ago. Mr. Ponsonby has made a thorough study of many of these lies, and here gives the sources of many of them. The unfortunate thing is that such a book as this will be read by too few people, and when there is another war, we shall probably be just as ready to believe as we were in 1917.

Group Psychology
Science News-Letter, April 20, 1929

WAR AS AN INSTRUMENT OF NATIONAL POLICY—James T. Shotwell—*Harcourt, Brace* ($3.50). A history and discussion of the entire movement for the outlawry of war which has now culminated in the Kellogg treaties by the man most competent to write about it, since Prof. Shotwell of Columbia University was a member of the American Peace Commission and has been for the last ten years engaged in the preparation of the Carnegie "Economic and Social History of the World War", the most extensive and authoritative history of any war ever written.

Science News-Letter, April 20, 1929

THE READING INTERESTS AND HABITS OF ADULTS—W. S. Gray and Ruth Munroe—*Macmillan* ($3.50). Educators and librarians will be interested in this careful study "to discover what is in the experience of some persons which causes them to acquire and continue desirable habits of reading, and what is lacking from the experience of others which leaves them without such habits."

Bibliography
Science News-Letter, April 20, 1929

NOAH'S CARGO—George Jennison—*Macmillan* ($3.50). Parrots, elephants, bullfights, pelicans, chimps, flamingoes—two by two and three by three and in all assorted numbers: what a gaudy time Capt. Noah must have had! This book takes the reader for no end of zestful and sometimes breathless little excursions among animals, real and imaginary, historical and fictional. Where the author collected all this miscellaneous information is hard to imagine, but it reads like Sindbad and is as hard to lay down.

Zoology
Science News-Letter, April 20, 1929

BLOOD—Lawrence J. Henderson—*Yale University Press* ($5). This book with the murder story title is concerned quite literally with blood, being an advanced study in general physiology. It comprises the Silliman Lectures given at Yale University. The book is too technical for the lay reader but will be of interest to the physiologist, biological chemist and physician.

Physiology
Science News-Letter, April 20, 1929

GUIDE TO THE USE OF LIBRARIES, A MANUAL FOR COLLEGE AND UNIVERSITY STUDENTS, 4th ed.—M. Hutchins, A. S. Johnson and M. S. Williams.—*Wilson* ($1.25). Librarians are often horrified to discover a college graduate who has no conception of the operation of a library. It is an important thing to know at any age, but should be learned in high school or college. This book supplies all of the most necessary information.

Bibliography
Science News-Letter, April 20, 1929

ENROLLMENT IN THE FOREIGN LANGUAGES IN SECONDARY SCHOOLS AND COLLEGES OF THE UNITED STATES—Compiled by Carleton A. Wheeler and others—*Macmillan* ($2). A thorough statistical study, showing trends and relative conditions in different regions of the country, among students of different ages, communities of different sizes. The study reveals that conditions vary very much from city to city and state to state. Latin, for example, is studied by 32 per cent. of high school pupils in the south, but by less than 10 per cent. in California. Since language teaching in American schools is a controversial and important educational problem this investigation is a valuable basic document.

Education
Science News-Letter, April 20, 1929

PEAKS OF INVENTION—Joseph Leeming—*Century* ($2.50). In the twelve interesting chapters of this book the author tells of some of the most important developments of the twentieth century, such as the modern submarine cable, the marvels of chemistry, radio, telephone, superpower, modern telescopes, etc. Though many of these originated before the present century, it has been in the last twenty-five years that they have had their most striking development, and it is with this phase that the author is particularly concerned.

Invention
Science News-Letter, April 20, 1929

First Glances at New Books—*Continued*

THE INDUSTRIAL DEVELOPMENT OF SEARLES LAKE BRINE—John E. Teeple—*Chemical Catalog* ($3). One novel feature of the origin of this book is explained by the author in the preface: "This information . . . belongs to the American Potash and Chemical Corporation, it was done at their initiative and was paid for with their money. It has now largely served its original purpose, and normally would have spent the rest of its existence buried in their files. . . . One could wish that other chemical corporations would likewise release data from their files when it can be done without furnishing ammunition to direct competitors. Scientific information is about the only valuable commodity we are accustomed to bury for fear someone else might derive benefit from it." Searles Lake, in California, has proven a valuable source of sodium and potassium salts.

Chemistry
Science News-Letter, April 20, 1929

FUNDAMENTALS OF PHYSICS—A. L. Fitch—*Crowell* ($2.50). A new college text, based on the course as given by the author at the University of Maine, thus assuring its practical character. Many of the latest advances are included, and a number of pictures of physicists (several obtained from Science Service) add to the interest of the work from the student's viewpoint.

Physics
Science News-Letter, April 20, 1929

PRACTICAL RAILWAY PAINTING AND LACQUERING—H. Hengeveld, C. P. Disney and William J. Miskella—*Simmons-Boardman* ($3.50). A new volume in the Practical Finishing Series of the Finishing Research Laboratories of Chicago, which fully covers the subject with practical information. Of particular interest to the layman is the account of painting methods used on the great Quebec Bridge.

Technology
Science News-Letter, April 20, 1929

YOUR TEETH—Charles I. Stoloff—*Dutton* ($2.50). Using the question and answer form, this book gives detailed information about the structure and care of the teeth and about diseases of teeth and mouth and explains the methods and terms of modern dentistry. Many good illustrations add to an easy understanding of the subject.

Dentistry
Science News-Letter, April 20, 1929

GODS AND MEN—W. J. Perry—*Morrow* ($1). This little book summarizes the theory elaborated by Prof. Perry of Manchester University in his earlier books, *The Children of the Sun*, and *The Growth of Civilization*. From his study of the legends of the Pawnees, Samoans, Egyptians, Hindus, etc., he has come to the conclusion that religion arose from the identification of the King with the sun as the source of life and in the ritual intended to secure the continuance of his favor after death.

Theology
Science News-Letter, April 20, 1929

RADIO UP TO THE MINUTE—Arthur R. Nilson—*Clode* ($2). A concise and well written book that lives up to its title. Included are accounts of the latest forms of vacuum tubes, speakers, short-wave apparatus and television receivers and transmitters.

Radio
Science News-Letter, April 20, 1929

INTRODUCTION TO THE TECHNIC OF CHILD ANALYSIS—Anna Freud—*Nervous and Mental Disease Pub. Co.* ($1.50). The usual methods of psychoanalysis are not applicable to children, the daughter of the famous Freud has found. In these lectures, originally given for the Vienna Psychoanalytic Society, she explains the "wild" method which she has borrowed from psychoanalysis and which she has found effective with her young patients.

Psychiatry
Science News-Letter, April 20, 1929

INFANCY AND HUMAN GROWTH—Arnold Gesell—*Macmillan* ($3.50). The book gives the story of how a baby's mind develops during its first few years. Dr. Gesell is an authority and this collection of his observations and conclusions will be hailed by psychologists, physicians and educators. It is not beyond the scope of parents, although the scientific style may prove troublesome. The volume is profusely illustrated with charts and excellent photographs.

Child Psychology
Science News-Letter, April 20, 1929

MAKING GOODS AND MAKING MONEY—Horace Taylor—*Macmillan* ($2.50). An addition to the modern literature on economics. The author concludes that a unification of social interests in making goods with individual interests in making money will not, alone, cure our economic ills.

Economics
Science News-Letter, April 20, 1929

THE WEED FLORA OF IOWA—L. H. Pammel and Charlotte M. King—*Iowa Geol. Survey*. A new edition of Prof. Pammel's widely known and much used work on weeds. It is, of course, of value throughout the whole upper Mississippi Valley.

Botany
Science News-Letter, April 20, 1929

THE FROGS AND TOADS OF THE CHICAGO AREA—K. P. Schmidt—*Field Museum* (25c). This is a slender pamphlet, but contains information out of proportion to its size. There is a good key and plenty of clear illustrations. It will be useful to students far outside the area to which its title limits it.

Zoology
Science News-Letter, April 20, 1929

A Geologist's Religion

Theology

Shortly before the death of the famous geologist, Prof. Thomas C. Chamberlin, of the University of Chicago, the *Open Court* magazine for September, 1928, printed an article by J. V. Nash on "Professor Chamberlin, Dean of American Scientists, on the Future of Man". Excerpts from this article were published in the SCIENCE NEWS-LETTER for October 13, 1928. In this republication it was not made clear that the remarks of Prof. Chamberlin were given in an interview with Mr. Nash, nor was it indicated that the republication consisted of excerpts rather than a continuous quotation. Professor Chamberlin's statements were in the nature of informal oral replies to questions and were not revised by him.

Science News-Letter, April 20, 1929

Ecuador's entire farming region has almost uniform temperature through the year.

CLASSICS OF SCIENCE: Inheritance of Acquired Characteristics

Biology

Lamarck's laws set forth one of the early forms of the theory of evolution, a generation before Darwin. Their weakness is apparent now, but they were a long step in advance of the ideas of a static world then widely held. Lamarck's researches were done upon invertebrates, which is well illustrated by his constant distinction between generation and reproduction. In this connection it must be remembered that the mechanism of reproduction and transmission of heredity was practically unknown in Lamarck's day.

NATURAL HISTORY OF THE INVERTEBRATE ANIMALS, presenting the general and particular characters of these anmials, their distribution, their classes, their families, their genera, and a list of the principal species into which they fall; preceded by an Introduction presenting the determination of the essential characteristics of animals, their distinction from plants and other natural bodies, and finally, the explanation of the fundamental Principles of Zoology. By M. De Lamarck. Paris, 1815. Translated for the SCIENCE NEWS-LETTER, *by Helen M. Davis.*

Science News-Letter, April 20, 1929

The Four Laws

After the smoothing away of the first difficulty which spontaneous generation offers us at the beginning of every organic kingdom, as well as to that of certain branches of these kingdoms, everything else relative to the composition of the organization in these animals, and to the formation of the different special organs which are observed among them, seems to me to resolve itself easily.

In effect, one may say that these difficulties disappear if, to the minor generalizations of nature, we add the four following laws which concern the organism, and which govern all the acts which are forced upon it by the operation of the life forces.

First law: Life, by its unique forces, tends continually to increase the volume of every body which possesses it, and to extend the dimensions of those parts to as great limits as it can bring itself.

Second law: The production of a new organ in an animal body, results from an unexpected new need which continues to make itself felt, and from a new movement which this need brings forth and keeps going.

Third law: The development of organs and their force of action are constantly in proportion to the use of these organs.

Fourth law: All that which has been acquired, developed or changed, in the organization of the individuals in the course of their life, is conserved by the generation and transmitted to the new individuals which arise from those which have survived the changes.

It is impossible to understand anything of the construction of the organism, and especially of the operations of nature in regard to the animals, without the recognition of these laws, in a word, without truly taking them into consideration. In consequence, I am going to present the same successively, with only the development necessary to demonstrate their reality and importance.

First Law

It is known that every living body does not cease to grow, from the instant when it is animated by life, up to a particular moment of its existence, which is relative to that of the individual race. The body would increase during the entire course of its life, if a well-known cause did not put an end to its growth after the first quarter, approximately, of its duration.

The active life being constituted by the vital movements, it should be known that it is principally in the movements of the fluids peculiar to the living body that there resides the power which life possesses of extending the volume and the walls of the body; for nutrition alone is never enough; being in no sense a force; and it can increase, from within or without, the volume and the walls of the body on which it acts.

But if, in each individual, the power of life tends without ceasing to increase the size of the body and its walls, that power does not prevent the length of life from bringing gradually and constantly, in the state of the walls, the changes (a progressive stiffening and rigidity) which put an end to the growth of the individual, and afterward an end also to the life itself which it possesses. And so, these are those increasing and well-known changes which constitute the cause that, contrary to the tendency of life, limits the growth of the individual, and the same which necessarily brings its death after a time in proportion to the length of its growth. . . .

Second Law

The foundation of this law derives its proof from the third of these known facts, there can be no doubt; for, if the forces which form an organ, by their growth, develop that organ further, that is to say, increasing its size and its power, which is constantly proved by fact, one may be assured, that the forces which will act upon it, coming to birth by feeling a new need, will necessarily give birth to a new organ proper to meet the new need, if that organ did not exist before. . . .

Third Law

This is not a supposition, an indefinite presumption; the law which I present is positive, confirmed by observation, and belongs to the sum of known facts, which can serve to demonstrate the foundation of it.

Instead of reducing it to its simplest expression, as here, I have presented it, in my *Philosophy of Zoology* (vol. I, chap. 7), with the kind of development necessary at that time, and I have expressed it in the following manner:

"In every animal which has not passed the end of its development, the more frequent and extended use of a certain organ, strengthens little by little that organ, develops it, increases it, and gives it strength proportional to the duration of that use; in the same way the constant lack of use of such organ, insensibly causes it to fail, weakens it, progressively diminishes its powers, (*Turn to next page*)

Acquired Characteristics—*Continued*

and ends by making it disappear." *Phil. Zool,* p. 235. . . .

I regard this same law as one of the most powerful means employed by nature to diversify the races; and on reflecting upon it I know that it includes the necessity of that which precedes it, that is to say, of the second, to which it furnishes the proof.

Effectively, the cause which forces an organ frequently and constantly used to develop, which therefore increases its size and power of action, in a word, which causes the forces of life and the fluids of the body to flow there repeatedly, has necessarily also the power to cause to come into being, little by little and in the same way, an organ which has not existed and which has become necessary.

But the second of these laws and the third by which it acts, would be without effect, and consequently useless, if the animals always existed in the same circumstances, if they in general and always kept the same habits and if they were never changed nor formed anew; something which has been, in effect, believed and which has no foundation.

The error into which we have fallen in this regard, takes its source in the difficulty which we find of including in our observations a considerable period of time. There results for us the appearance of stability in the things which we see, a stability, which nevertheless, nowhere exists. . . .

In order to continue such an opinion and hold to an error of that kind, it is indeed necessary to keep oneself from collecting and considering the facts which we have presented from all; and it is necessary to reject all the observations which confirm them; for things are surely very different. . . .

If one now reflects what enormous diversity of circumstances of living conditions, of exposure, or climate, of nutritive substances at their disposition, of favorable surroundings, etc., the plants and the animals have had to endure, in proportion as the existing races have found it necessary to change their habitat and although these changes come about with extreme slowness and in consequence during a considerable time, their reality, compelled by different causes, has none the less put the races which have found themselves exposed to them to the necessity of changing little by little their manner of living, and their habitual behavior.

By the effects of the 2nd and 3rd laws cited above, these changes of habit therefore must have forced the birth of new organs, and have been able afterward to develop them, if their use is subsequently very frequent; they have been able to deteriorate in the same way, and at last atrophy, those of the existing organs which thereafer have proved useless.

Another cause of change of habit which has helped to diversify the varieties of the animals and to multiply the races, is the following:

In proportion as the animals, by partial emigration, changed their place of living and went to different parts of the surface of the earth; newcomers in new situations, they would be exposed to new dangers which exact new actions to escape them; for the most of them devour one another to preserve their existences.

I have no need to enter into more detail to show the influence of this cause which it is necessary to add to that which embraces the different circumstances of the new homes, of the new climates, and of the new ways of living following such emigration.

But, one might say, since the animals have gradually populated every place where they can live, since all the waters are peopled with species which can nourish them, since the dry parts of the globe serve as habitation to the species which we see; things are stable in respect to them; circumstances capable of forcing them to changes of living conditions have no place; and all the races, at least in the future, will remain always the same.

To that I reply that this opinion again seems to me an error; and that I am entirely persuaded that it is.

It is a great advantage, in effect, to suppose that there has been absolute stability in the state of the surface of our world as we know it; in the condition of its waters, whether fresh or salt, in the depth of its valleys, the elevation of its mountains, the disposition and the composition of its particular places; in the different climates which now correspond to the different parts of the land with which they are now associated; etc., etc.

All these objects should, it seems to us, remain just about the same in the state in which we observe them, for we cannot be witnesses ourselves to their changes, and our history and our written observations from dates so little removed from us do not show it to convince us of our error. Nevertheless we do not lack positive facts which indicate it; but as this is not the place to recall them, I shall confine myself to the expression of my belief; know:

That everything changes unceasingly on the surface of the globe, although with extreme slowness in respect to us; and that the changes which occur there, necessarily force the races of plants and animals to adapt themselves to them, which helps to diversify them without real discontinuity . . . .

Fourth Law

This law, without which nature could not diversify the animals, as she has done, and establish among them a progression in the composition of their organization and in their faculties, is explained also in my *Philosophie zoologique* (vol. I. p. 235).

"Everything which nature has caused to be acquired or lost in the individuals by the influence of circumstances to which their race has been for a long time exposed, and, in consequence, by the predominant influence of the use of such organ, or similarly lack of constant use of such part, she conserves, by generation, to the new individuals who carry it on, provided that the changes acquired are common to the two sexes, or to those which have produced the new individuals."

This expression of the same law offers some details which it would be better to reserve for development and application, which, however, is scarcely necessary. . . .

In truth, in sexual reproduction, the mixture between individuals which have not equally been subjected to the same modifications in their organization, seems to offer some exception to the results of this law; since some of the individuals which have suffered some of the changes do not transmit them all, or only communicate them partially to those which they produce. But it is easy to realize that this is scarcely a real exception; the law itself can have only a partial and imperfect application in these circumstances.

By the four laws which I have indicated to you, all the facts of organization seem to me to be easily explained; the progress in the composition of organization of the animals and in their faculties, seems to me easy to conceive; finally, the means which nature has employed to diversify the animals, and to bring all to the state in which we see them, is through them easily determinable.

Jean Baptiste Pierre Antoine de Monet Chevalier de Lamarck (1744-1829) was an authority on botany until 49, afterward on invertebrate zoology. He was blind before his "Histoire naturelle" was completed